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The present study investigated solid state secondary lithium cell systems, especially $Li/PEO,LiCF_3SO_3/V_6O_{13}$. The material necessary to fabricate thin film (100-200 μm) cells were characterized and the behavior of the cells was investigated as a function of cycle number, humidity, overcharge, temperature and rate. Cell performance looked promising with continued cycling. Results were reported in twenty-one technical publications.

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The investigation of polymeric solid electrolyte cells, carried out during a nominal three-year period, focused on the rechargeable lithium battery,

$$Li/PEO,LiCF_3SO_3/V_6O_{13} \qquad (I)$$

where polyethylene oxide (PEO) and the lithium salt form on ionically conductive complex. The objective was to characterize thin, solid state electrochemical cells and identify those problems that may impact scale-up of the cells and their ultimate usefulness.

The results of the investigation were reported in scientific journals and presented at various conferences, as summarized by the listing in Table 1. The individuals who participated in the research are the following:

Dr. R. Gopaliengar
Tom Hayes
John David Locatus
Gonzalo Mortinez
Dr. M. Zafar A. Munshi
Son Nguyen
Dr. Boone B. Owens
P. Van Sickle
Dr. Paul Skarstad
Oanh Vo

The accomplishments of this program included the following:

(1) New materials properties were reported for lithium polymer electrolytes.

(2) A process was developed for the preparation of polymeric composite cathode structures containing solid cathodes (V_6O_{13}), carbon and polymer electrolytes.

(3) Rechargeable lithium cell performance was investigated as a function of cycle number, humidity, overcharge, temperature and rate.

(4) Morphological changes at the electrode/electrolyte interfaces were assessed after cycling. The uniformity of the electrode surface indicated no problems with long-term cycling in these electrodes with very low loadings and the low current densities that are inherent in the design.

The cells look promising for additional development. Further studies should assess modelling of performance as a function of design, scale up, behavior of multi-cell designs and hardware designs that will maintain adequate mechanical constraints on the cells. Overcharge stable designs are an important objective. A major goal should be to incorporate room temperature polymer electrolytes into the designs to permit wider applications.

Table 1. ONR Technical Reports, Contract N00014-85-K-0634

Technical Report #	Title and Reference
1	"Solid State Batteries", M.Z.A. Munshi & B.B. Owens, Proc. of the Symp. on Electrochem. and Solid State Science Education at the Graduate and Undergraduate level, Ed. W.H. Smyrl and F. McLarnon, Proceeding Volume 87-3, The Electrochemical Society, p. 116 (1987).
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Technical Report #	Title and Reference

8 "Applications of Multivalent Ionic Conductors to Polymeric Electrolyte Batteries," J.Y. Cherng, B.B. Owens, W.H. Smyrl, & M.Z.A. Munshi, Proceedings of the 6th International Meeting on Solid State Ionics, Garmisch - Partenkirchen, W. Germany, Sept. 6-11, 1987; Solid State Ionics, 28-30, p. 857 (1988).

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